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## Notes on *Triepeolus remigatus* (Fabricius), a "Cuckoo Bee" Parasite of the Squash Bee, *Xenoglossa strenua* (Cresson) (Hymenoptera : Apoidea)

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*Xenoglossa strenua* (Cresson) is a large tawny-colored bee whose range (Hurd and Linsley, 1964) is transcontinental from Maryland and Florida west to southern California and south to Durango, Mexico. It limits its pollen collecting to the genus *Curcubita* and nests in bare or nearly bare areas of flat ground near its host plants. Data on its flower visiting and nest building habits and developmental stages have been published (Bohart, 1964). The following observations of its "cuckoo bee" parasites were made at the Agricultural Research Center at Beltsville, Maryland.

*Triepeolus remigatus* (Fabricius) is a large species (about 14 mm long). The characteristic color pattern on the first two metasomal tergites and the longitudinal pale marks on the mesonotum distinguish it from other species in the genus (Fig. 1). It ranges through the same states inhabited by *Xenoglossa strenua* and is probably parasitic on it throughout this extensive territory.

During August 1957, at Beltsville, both sexes of adult *T. remigatus* were seen investigating the ground surface in the vicinity of a squash patch. Although *X. strenua* was commonly seen early in the morning on the squash flowers, *T. remigatus* was not found visiting flowers.

An *X. strenua* nest in which a female *T. remigatus* had been seen to stay for several minutes was excavated. The first cell examined had an apparently unaltered ceiling and no external evidence of parasitism. An egg of *X. strenua* was situated on the pollen mass. As judged by the dry crumbs on top of the otherwise moist food mass, oviposition had just occurred. About 3 mm below the neck of the cell, a *Triepeolus* egg had been placed at right angles to the cell wall and was extended through it. The anterior end of the egg was nearly flat, had several



Fig. 1. Adult female of *Triepeolus remigatus* Fabricius.

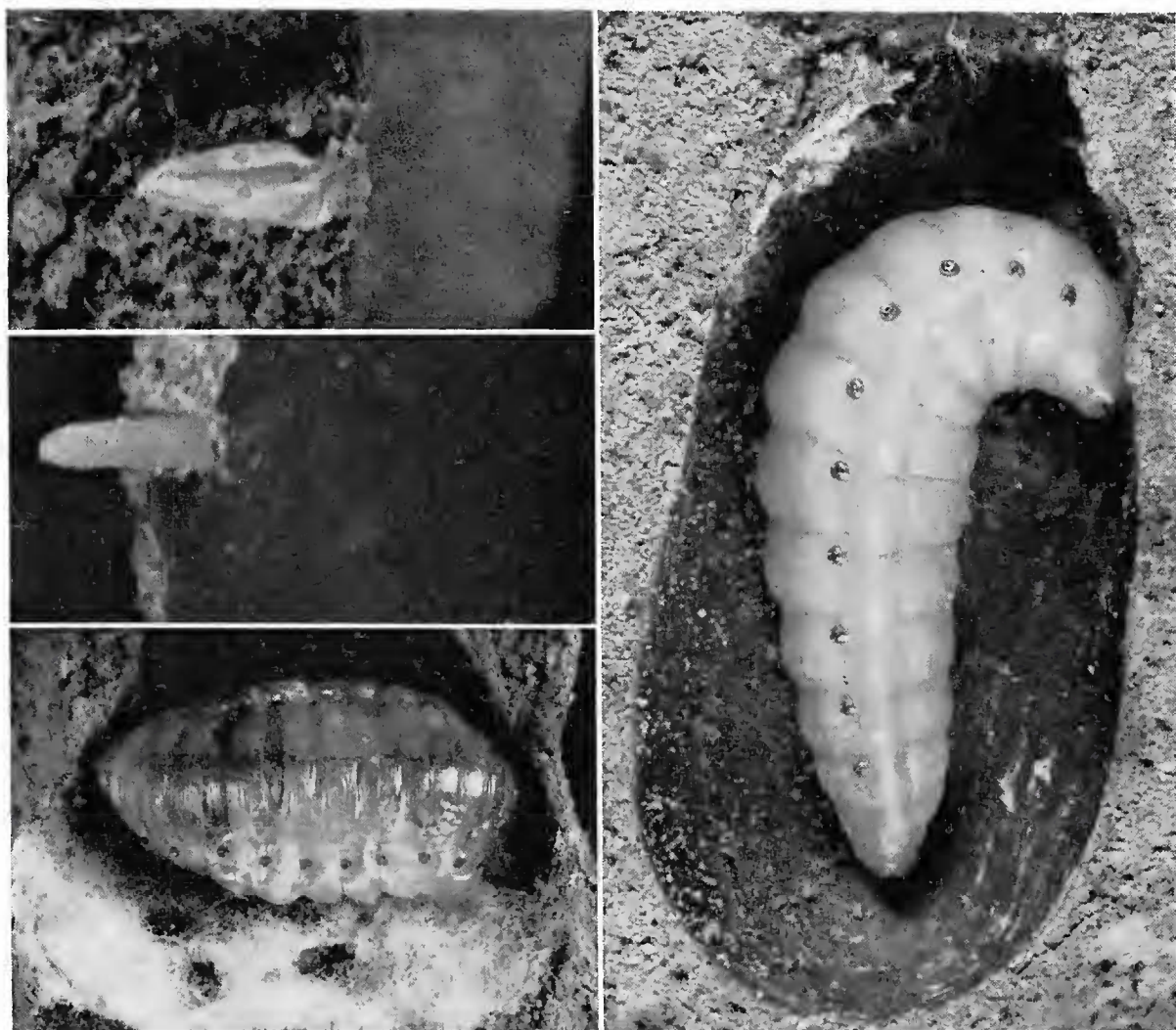


Fig. 2 (upper left). Egg membrane in wall of host cell. Fig. 3 (middle left) Egg in wall of host cell. Fig. 4 (lower left) Fourth instar larva in cell shortly after molting. Fig. 5 (right) Prepupa in host cell showing fecal pattern.

circular wrinkles, and was flush with the wall (Fig. 3). It was 2 mm long, approximately 0.48 mm wide, and roughly cylindrical. When examined in the lab, the egg showed numerous closely spaced annulations (Fig. 8). The next day, however, after being in a moist petri dish, the annulations had nearly disappeared. Apparently the egg can lose or absorb moisture depending upon the amount of moisture in the cell or its wall.

How the egg had been deposited in the cell wall in the position noted with no cavity or other sign leading to it is a mystery. Apparently a cylindrical hole just accommodating the egg had been made from the inside of the *X. strenua* cell before oviposition took place. Other species of *Triepeolus* have been seen to oviposit in a similar manner (personal observation). The adult female of this and other species of *Triepeolus* have a pair of long hooklet-bearing arms of the sixth metasomal sternum



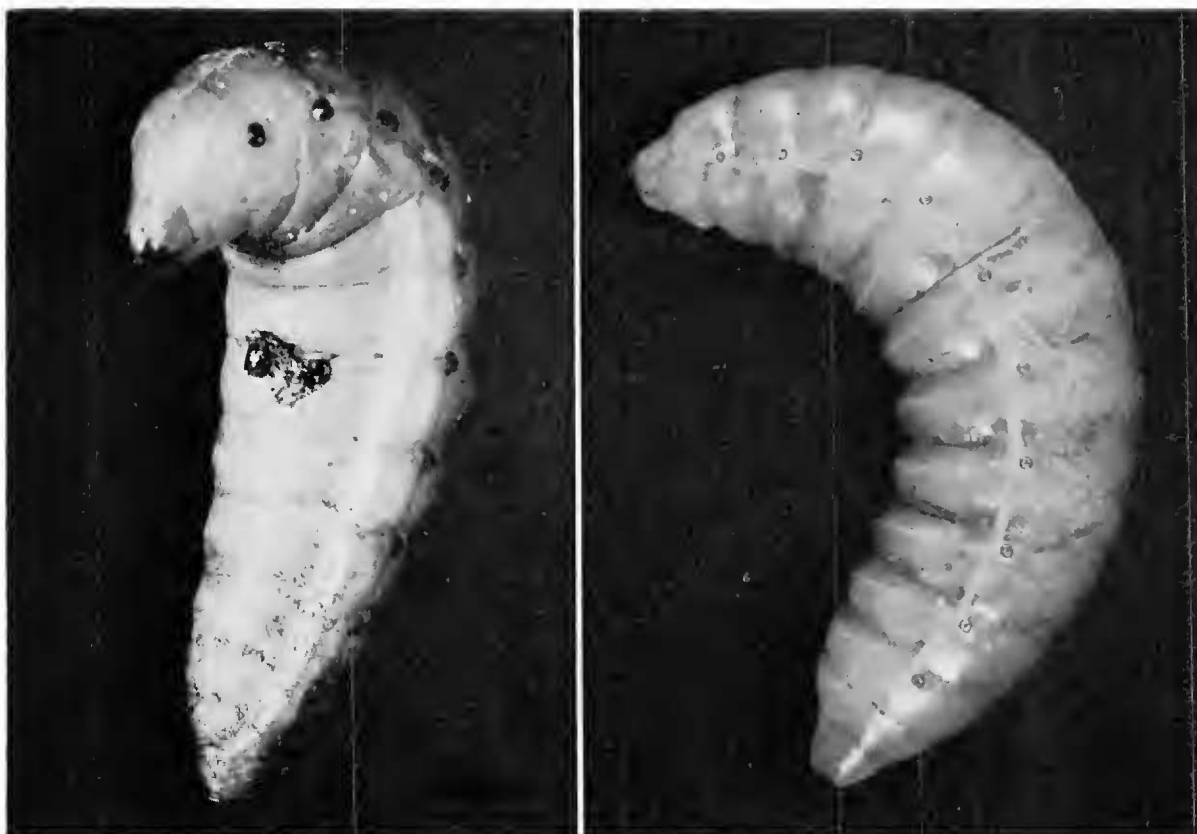


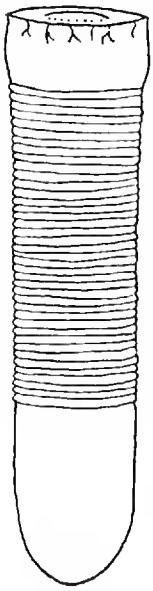
Fig. 6 (left) Prepupa showing remnants of earlier instar exuvia. Fig. 7 (right) Full-grown larva in lateral view.

flanking the sting (Fig. 1). These arms must be used in the oviposition process in some as yet unknown fashion.

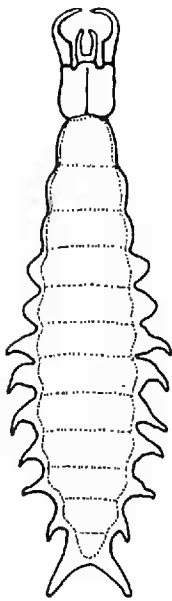
The following descriptions of eggs and larvae are generalizations based on observations of a number of specimens. The position of the *T. remigatus* egg in the cell wall indicates that the larva forces its way out of the anterior end of the egg, leaving the membrane imbedded in the wall (Fig. 2), and then proceeds down the waxy surface of the cell and across the food mass to the egg of its host. This method of hatching appears to be unique to nomadine bees and is undoubtedly associated with the mobility of the first instar that characterizes most parasitic bees (see Linsley and MacSwain, 1955). The mobility of

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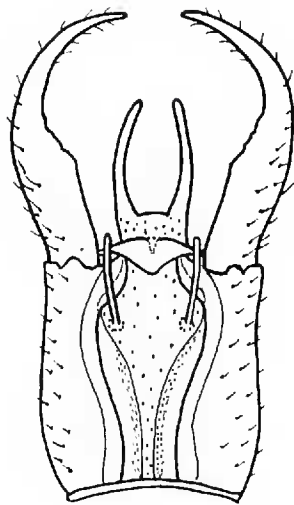
Fig. 8. Egg in lateral view (before absorption of water). Fig. 9. First instar larva in dorsal view. Fig. 10. First instar larva—head capsule in ventral view. Fig. 11. First instar larva—head capsule in lateral view. Fig. 12. Second instar larva—head capsule in lateral view. Fig. 13. Second instar larva—head capsule in dorsal view. Fig. 14. Second instar larva—head capsule in ventral view. Fig. 15. Full-grown larva—spiracle in anterior view and in longitudinal section. Fig. 16. Full-grown larva—spiracle in interior view.



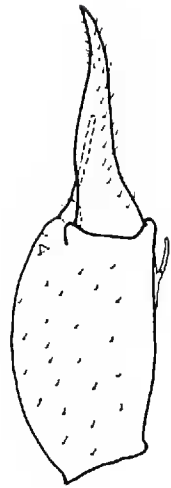
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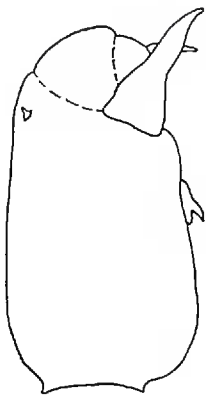
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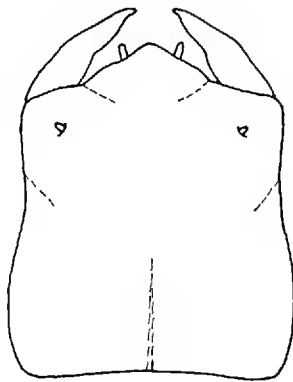
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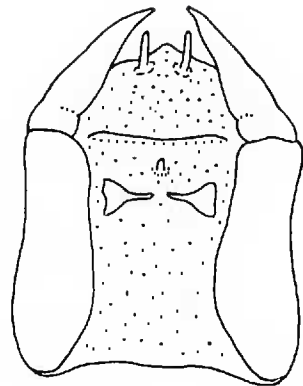
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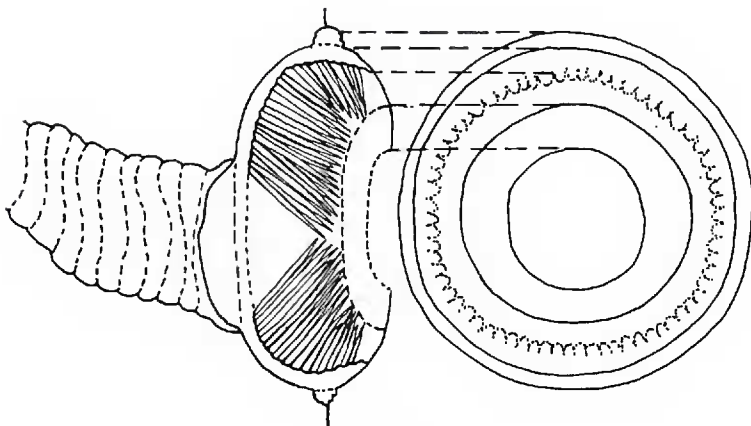
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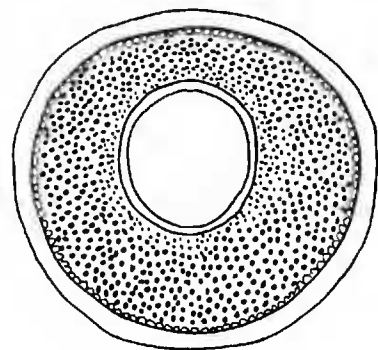
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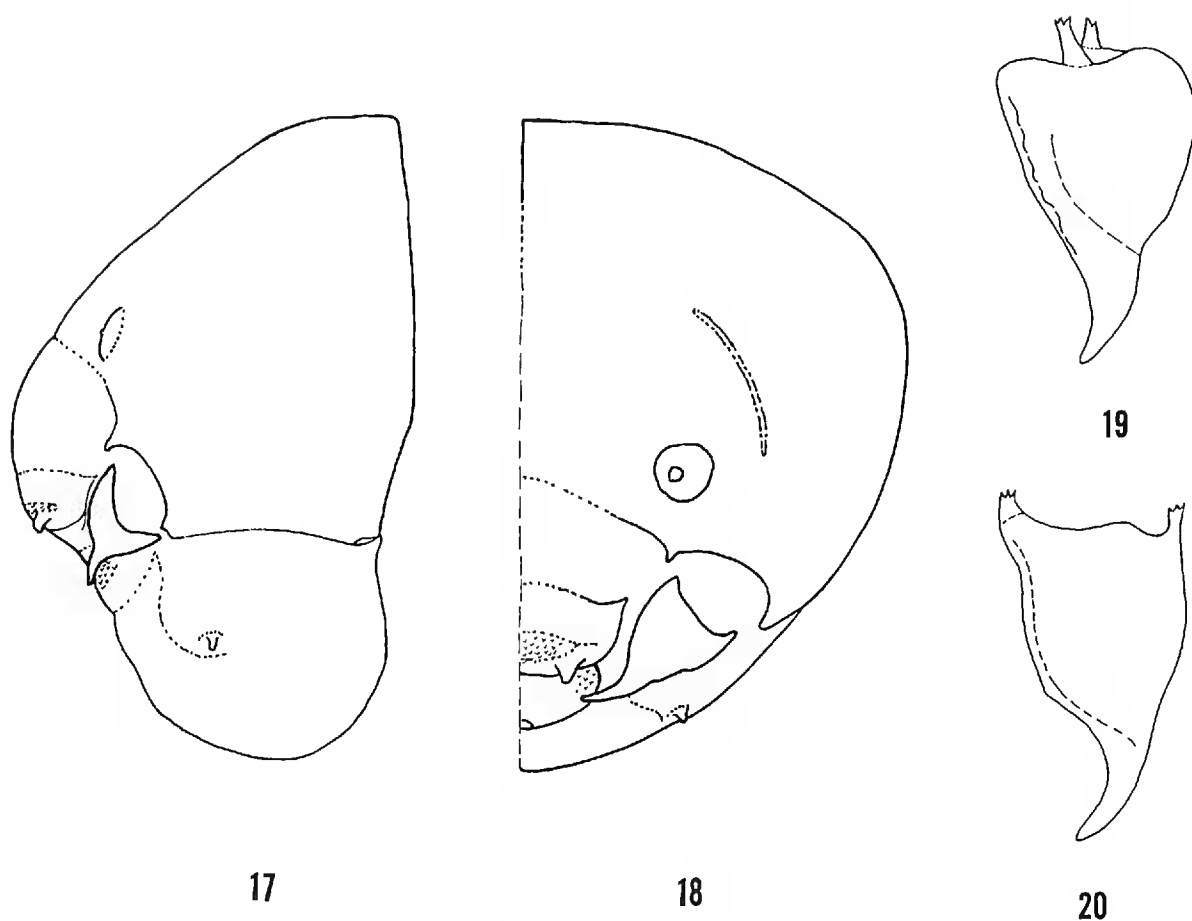


Fig. 17. Full-grown larva—head capsule in lateral view. Fig. 18. Full-grown larva—head capsule in anterior view. Fig. 19. Full-grown larva—mandible in interior view. Fig. 20. Full-grown larva—mandible in ventral view.

first instar *T. remigatus* is obviously facilitated by its narrow body form and lateral segmental lobes (Fig. 9). The large head with its long, sickle-shaped mandibles (Figs. 10 and 11) adapted for crushing the host egg is probably also used for combat with other first instar *T. remigatus*. In several of the excavated *X. strenua* nests I found one or two dead first instar *T. remigatus* in addition to a cast skin and a more advanced stage feeding on the pollen. No purpose is known for the pair of long, palpus-like labral lobes between the mandibles. Another remarkable feature of the first instar larva is the pair of long labial palpi on the ventral side of the head. I was unable to find any maxillary palpi.

The second instar (3 to 4 mm long) has a similar body form to the first, but the lateral segmental lobes (except the posterior ones) are less well developed. However, the lateral lobes are probably more pronounced in freshly molted individuals than in the ones I observed, which were nearly ready for their second molt. The second instar head capsule is drastically altered (Figs. 12, 13, 14). The most prominent

structural features of the first instar head capsule (mandibles, labral lobes, and labial palpi) are much reduced in the second instar but, even so, are much more highly developed than is usual for bee larvae. It is not clear whether the size and shape of these structures in the second instar indicate a special function or merely represent a graduated step in the extreme change from the condition of the first to that of the third instar.

The third instar is much broader than the first or second, but the lateral lobes are almost as prominent as in the second. Its head capsule is essentially like that of the fourth instar. Shortly before molting, larvae in this stage are about 6 mm long.

The fourth instar grows rapidly until it reaches about 18 mm in length. At first the segmental lobes are moderately prominent (Fig. 4), but when full-grown the larva becomes smooth and shiny (Fig. 7). In this stage it can be differentiated from the *X. strenua* larva by its less mobile thoracic region and by the less prominent conical projection of the apical abdominal segment. Among the features that distinguish it as a *Triepeolus* are the narrow mandibular apices (Figs. 19, 20) and the large, heavily armored spiracles (Fig. 5). Similar spiracles are found in other Nomadinae, but they differ in detail among the various genera (Michener, 1953).

The head capsule differs from that drawn by Michener (1953) for *Triepeolus* (undetermined species) in having no labial palpus (Figs. 17, 18) and a different curvature of the mandibular tooth (Figs. 19, 20). The spiracle differs primarily in having longer, more numerous spines in the atrium (Fig. 15). An interior view of the atrium showing the spine insertions is particularly striking (Fig. 16).

*T. remigatus* larva spins no cocoon and waits for perhaps a day after feeding before depositing feces. These are pressed against the walls of the cell as vertical, flattened, overlapping strips. The heaviest accumulation is in an equatorial belt (Fig. 5). After defecating, the larva becomes rigid with its abdomen straight and its thorax bent strongly forward. The prothorax and head are bent downward. The larva is now dorsoventrally flattened and its lateral abdominal lobes are prominent. At this stage the 10 pairs of large spiracles look like shiny hemispherical buttons (Fig. 5). In ventral view the early instar exuvia are usually still attached to the anterior abdominal region (Fig. 6).

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### Five New Species of Phalangodidae from California (Opiliones)

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A winter reconnaissance of various habitats in northern and central California revealed several undescribed phalangodids of unusually small size. The results of this study are further indication that these arachnids are worthy of continued research. They are predictably located and are often the major if not the sole occupant of their restrictive under-surface habitat. Several important populations are now being threatened by suburban development.

Application of the limited characters for generic classification used by Goodnight and Goodnight (1953) in their study of the Mexican Phalangodidae indicated that this collection belonged in genus *Sitalcina* Banks although some of these new species have an unusually small number of tarsal segments on the second pair of legs. All specimens of *Sitalcina* examined by the authors possessed the calcaneus and astragulus divisions of the femora and metatarsi on all legs. These divisions were described as absent from the metatarsi of the species of *Sitalcina* reported by Goodnight and Goodnight (1942).

The characters of *Sitalcina* are revised as follows to accommodate the broadened generic characters of 1953 (op. cit.):

#### SITALCINA Banks, 1911

- Sitalces* (part) Banks, 1893. *Trans. Amer. Ent. Soc.*, 20: 15.
- Metapachylus* Banks, 1909. *Proc. Acad. Nat. Sci. Philadelphia*, 61: 230.
- Sitalcina* Banks, 1911. *Pomona Jour. Ent.*, 3: 412–421.
- Goodnight and Goodnight, 1942. *Amer. Mus. Novitates*, No. 1188, p. 8.
- Paramitraceras* (part) Roewer, 1912. *Arch. Naturg.*, 77A: 155.
- Pachylicus* (part) Roewer, 1923. *Die Webernechte der Erde*, p. 118.